MICRONEEDLE SYSTEMS AND APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. application Ser. No. 12/197,583, filed on Aug. 25, 2008, and entitled Microneedle Systems and Apparatus, now U.S. Pat. No. 11,154,698, issued Oct. 26, 2021 (Attorney Docket No. G34), which claims the benefit of U.S. Provisional Patent Application Ser. No. 60/966,174, filed Aug. 24, 2007, and entitled Microneedle Systems and Apparatus (Attorney Docket No. DEKA-018XX), which are each hereby incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to microneedles and more particularly, to microneedle systems and apparatus.

BACKGROUND INFORMATION

[0003] Microneedles may be formed as arrays of varying densities. One such microneedle and production technique thereof is described in U.S. Pat. No. 6,558,361 and U.S. Pat. No. 6,533,949, which are both herein incorporated by reference in their entireties.

[0004] Microneedles may be used, for example, to transport fluids through a biological barrier, and are desirable for example because of the reduction in the amount of pain experienced by a human or other mammal receiving the fluids through a needle. Accordingly, there is a need for microneedles and system for use in transporting fluids, including insulin, through a biological barrier. There is also a need for a less painful analyte sensing device.

SUMMARY

[0005] In accordance with one aspect of the present invention, a medical system is disclosed. The medical system includes at least one compartment for a fluid, a fluid path and at least one microneedle fluidly connected to the at least one compartment by the fluid path.

[0006] Some embodiments of this aspect of the present invention may include one or more of the following: wherein the compartment is a non-pressurized compartment; wherein the fluid path extends through the microneedle; where the at least one microneedle is an analyte sensor; wherein the at least one microneedle having at least two appendages whereby the appendages provide for microneedle retention in a patient; wherein the at least one compartment for a fluid is contained within a housing; wherein the housing is a wearable housing; and/or wherein the housing is an infusion pump.

[0007] In accordance with another aspect of the present invention, a medical infusion system is disclosed. The system includes a wearable housing, at least one non-pressurized compartment for a fluid contained within the housing, at least one fluid path fluidly connected to the at least one compartment and at least one microneedle fluidly connected to the at least one compartment by the fluid path wherein the fluid path extends through the microneedle.

[0008] Some embodiments of this aspect of the present invention may include one or more of the following: wherein the at least one microneedle including a body portion and at least two appendages whereby said appendages provide for microneedle retention in a patient; wherein the body portion of the microneedle is made from a first material and the appendages are made from a second material wherein the second material is different from the first material and wherein the second material is dissolvable in a patient; and/or wherein the system further includes at least one microneedle analyte sensor connected to a path, wherein the path is connected to the wearable device.

[0009] In accordance with one aspect of the present invention, a medical infusion and sensing system is disclosed. The system includes a wearable housing, at least one non-pressurized compartment for a fluid contained within the housing, at least one fluid path fluidly connected to the at least one compartment, at least one microneedle fluidly connected to the at least one compartment by the fluid path wherein the fluid path extends through the microneedle; and at least one microneedle analyte sensor attached to a path, the path attached to the housing.

[0010] Some embodiments of this aspect of the present invention may include one or more of the following: wherein the wearable housing includes a reusable portion and a disposable portion; wherein the at least one microneedle comprising a body portion and at least two appendages whereby the appendages provide for microneedle retention in a patient; wherein the body portion of the microneedle is made from a first material and the appendages are made from a second material wherein the second material is different from the first material and wherein the second material is dissolvable in a patient; wherein the at least one compartment comprising at least one flexible portion; wherein the at least one compartment comprising a septum; wherein the system further includes a pumping mechanism for pumping fluid from the at least one compartment through the fluid path; and/or wherein the pumping mechanism is actuated using at least one shape memory actuator.

[0011] These aspects of the invention are not meant to be exclusive and other features, aspects, and advantages of the present invention will be readily apparent to those of ordinary skill in the art when read in conjunction with the appended claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] These and other features and advantages of the present invention will be better understood by reading the following detailed description, taken together with the drawings wherein:

[0013] FIG. **1** is a front view of a prior art microneedle;

[0014] FIG. **2** is a front view of a microneedle with appendages/fixtures;

[0015] FIG. **3**A is a is a front view of an array of microneedles;

[0016] FIG. **3**B is a cross sectional view of a substrate fluid path;

[0017] FIG. **3**C is a cross sectional view of a multi-referevoir device fluidly connected to a microneedle substrate fluid path;

[0018] FIG. **4** is a front view of a microneedle array on a pen needle;

[0019] FIG. **5** is an apparatus with a manifold and multiple microneedles;

[0020] FIG. **6** depicts a patient with a device and hand-held user interface assembly;

[0021] FIGS. **7**A-**7**D show cross section schematics of a device with a compartment; and